THE CLAIMS

What is claimed is:

1. A downhole tool for use in a downhole tool assembly, the tool comprising:

a first body and a second body mounted for relative rotation;

a joint part for use in forming a selectively releasable joint between the second body and a part of the assembly couplable to the second body; and

locking means for locking the first and second bodies relative to one another against relative rotation, in use, so as to allow a release force to be applied through the first body to release the releasable joint and allow the tool to be separated from the part of the assembly.

2. A downhole tool assembly that includes a downhole tool comprising:

a first body and a second body mounted for relative rotation;

a joint part for use in forming a selectively releasable joint between the second body and a part of the assembly coupled to the second body; and

locking means for locking the first and second bodies relative to one another against relative rotation so as to allow a release force to be applied through the first body to release the releasable joint and allow the tool to be separated from the part of the assembly.

3. The downhole tool assembly as claimed in claim 2, wherein the selectively releasable joint is configured to release

at a release force which is less than the force applied to make up the joint for drilling operations.

4. The downhole tool assembly as claimed in claim 2, wherein the downhole tool assembly comprises a downhole drilling assembly and the downhole tool includes a drilling motor for driving a drill bit of the assembly.

5. A downhole drilling assembly comprising:

a downhole drilling motor having a motor body for coupling to tubing of the assembly and a rotatable drive shaft for coupling to a drill bit of the assembly;

a selectively releasable joint located between the drilling motor and the drill bit; and

locking means for locking the drive shaft relative to the body of the motor to allow a release force to be applied through the assembly tubing and the motor body to release the releasable joint and allow the drill bit to be separated from a remainder of the drilling assembly.

6. The downhole drilling assembly as claimed in claim 5, wherein the selectively releasable joint is configured to release at a release force which is less than the force applied to make up the joint for drilling operations.

7. The downhole drilling assembly as claimed in claim 6, wherein the release torque is lower than 70% of the torque required to make up the joint.

8. The downhole drilling assembly as claimed in claim 7, wherein the release torque is in the region of 30-50% of the torque required to make up the joint.

9. The downhole drilling assembly as claimed in claim 5, wherein the selectively releasable joint is located between the motor shaft and the drill bit, to allow separation of the drill bit from the remainder of the drilling assembly at a location between the drill bit and the motor shaft.

10. The downhole drilling assembly as claimed in claim 5, wherein the joint comprises a threaded male pin and a co-operating threaded female box.

11. The downhole drilling assembly as claimed in claim 10, wherein the threads on the pin and box of the joint are configured such that:

$$1.0 < \frac{\text{joint Coefficient of friction}}{\tan(\text{helix angle})} > 3$$

where the tangent of the helix angle (α) is determined by:

$$\tan(\alpha) = \frac{\text{lead}}{2 \Pi r_a}$$

where r_a is the thread mean radius.

12. The downhole drilling assembly as claimed in claim 10, wherein the male pin is provided on an end of the motor shaft and the female box in the drill bit.

13. The downhole drilling assembly as claimed in claim 10, wherein the releasable joint further comprises a coupling member, one of the coupling member and the motor shaft defining the male pin and the other one of the coupling member and the motor shaft defining the female box.

14. The downhole drilling assembly as claimed in claim 13, wherein the coupling member includes a male pin for engaging a corresponding female box formed in the drill bit, for coupling the drill bit to the coupling member.

15. A downhole drilling assembly as claimed in claim 10, wherein the releasable joint further comprises a coupling assembly having first and second bodies, one of the first and second bodies defining the pin and the other of the first and second bodies defining the box.

16. The downhole drilling assembly as claimed in claim 15, wherein each of the first and second bodies have standard tapered threaded joints for coupling one of the first and second bodies to the motor shaft, and the other of the first and second bodies to the drill bit.

17. The downhole drilling assembly as claimed in claim 12, wherein threads on the male pin and the female box forming the releasable joint are configured to release at a lower torque than the make up torque.

18. The downhole drilling assembly as claimed in claim 5, wherein the releasable joint is a substantially cylindrical threaded joint.

19. The downhole drilling assembly as claimed in claim 5, wherein the locking means comprises locking members adapted to engage at least a part of the motor, to lock the motor shaft relative to the body of the motor.

20. The downhole drilling assembly as claimed in claim 19, wherein the locking members are placed in a string of the assembly tubing at surface for transportation down the string to the motor.

21. The downhole drilling assembly as claimed in claim 19, wherein the locking members comprise locking balls.

22. The downhole drilling assembly as claimed in claim 19, wherein the motor is shaped at an end thereof which is upstream in use to define at least one space for receiving the locking members.

23. The downhole drilling assembly as claimed in claim 5, wherein the drilling motor comprises a fluid driven turbine.

24. The downhole drilling assembly as claimed in claim 5, wherein the drilling motor comprises a positive displacement motor.

25. A method of selectively releasing a drill bit of a downhole drilling assembly from a remainder of the assembly, the method comprising the steps of:

providing the drilling assembly with a selectively releasable joint between a drilling motor of the assembly and the drill bit, and a locking means for locking a rotatable drill bit drive shaft of the drilling motor relative to a body of the motor;

activating the locking means to lock the motor shaft against rotation with respect to the motor body;

applying a rotational release force through tubing of the assembly and the motor body to release the releasable joint and separate the drilling motor from the drill bit; and

recovering the remainder of the drilling assembly to surface.

26. The method as claimed in claim 25, wherein the method further comprises the step of providing the selectively releasable joint between the drive shaft of the drilling motor and the drill bit.

27. The method as claimed in claim 25, wherein the step of activating the locking means further comprises the step of passing locking members down through the assembly tubing and into a part of the motor, to cause the drive shaft of the motor to lock relative to the motor body.

28. The method as claimed in claim 27, wherein the locking members are inserted into the assembly tubing at surface and transported through the tubing to the motor.

29. The method as claimed in claim 25, wherein the step of applying a rotational release force further comprises the step of applying a release torque to generate the release force, and wherein the release torque is less than the torque required to make-up the drilling assembly.

30. The method as claimed in claim 29, wherein the applied release torque is in the range of 30-50% of the make-up torque.